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CONTENTS.

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QUERY.

Can any reader of *Science* cite a case of lightning stroke in which the dissipation of a small conductor (one-sixteenth of an inch in diameter, say,) has failed to protect between two horizontal planes passing through its upper and lower ends respectively? Plenty of cases have been found which show that when the conductor is dissipated the building is not injured to the extent explained (for many of these see volumes of Philosophical Transactions at the time when lightning was attracting the attention of the Royal Society), but not an exception is yet known, although this query has been published far and wide among electricians.

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N. D. C. HODGES, 874 BROADWAY, N. Y.

SCIENCE

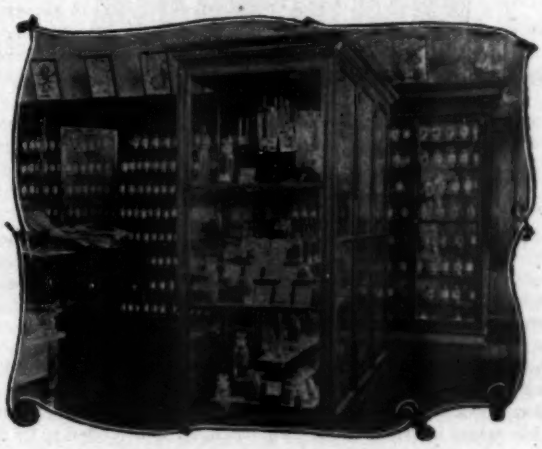
NEW YORK, APRIL 7, 1893.

THE WORK OF A BOTANICAL LABORATORY IN PHARMACEUTICAL MANUFACTURE.

BY JOHN S. WRIGHT, LABORATORIES, ELI LILLY & CO., INDIANAPOLIS, IND.

BOTANY is constantly growing in economic importance, each year we see some new and valuable practical application of it in industry or science. The many botanical laboratories maintained in connection with agricultural experiment stations testify as to its important work in agriculture. Brewers have seen so much practical value in botanical study of yeast that laboratories for this purpose have in some instances been established in connection with their plants; while it plays such an important part in the study of disease that many well-equipped hospitals and quarantine stations are provided with facilities for botanical investigation in the line of bacteriology.

GENERAL VIEW IN LABORATORY.



CRUDE DRUG COLLECTION AND MUSEUM CASE.

In pharmacy, botany has always occupied an important place, our first drugs were of botanic origin, and each year has added new plant products to drug-lists until now the hundreds of botanic drugs make, at least, a fundamental knowledge of botany a requisite for scientific pharmaceutical work, so that it now forms a part of every thorough course of study in pharmacy.

Though it bears this close relation to pharmacy, many persons, who should be acquainted with the facts, ask what service a botanical laboratory can render a pharmaceutical manufacturing establishment, so this article shall attempt to explain briefly the equipment and work of such a laboratory; as the writer is aware of the existence of but one such in this country, the article is of necessity an account of it.

Facilities for good systematic work are of the highest importance in such a laboratory, and in the one referred to there exists an herbarium of many thousands of species, representing the flora of the United States, and containing numerous forms from Europe and other foreign regions. An essential feature of the laboratory equipment is a jar collection of crude drugs representing nearly all the authenticated botanical products which enter into the manufacture of medicines. In connection with this, a line of crude drug adulterants is being collected.

A dissecting microscope, a good compound microscope with line of eyepieces, objectives, and other accessories provide means for microscopic work. A hand microtome, a large Bausch & Lomb laboratory microtome with reagents, and all necessary materials for staining and mounting sections comprise the outfit for histological work.

In addition to the study of herbarium specimens and cured plants, means are provided for work upon living plants, through the erection, in the laboratory, of a large glass propagating case, in which seeds are germinated and plants grown for study.

The laboratory is supplied with current botanical and microscopical journals, with standard texts and manuals on botany and pharmacy for reference. Briefly, in its equipment, the laboratory is not essentially different from that of any college in which systematic and structural botany are taught, except in point of number of workers for which it is arranged.

The laboratory was founded to provide accurate and scientific means for examining and identifying crude drugs. Many hundreds of botanic products find their way into medicine. These include roots, barks, leaves, flowers, fruits, and, in many instances, entire plants. As the list comprises drugs of widely diverse values and effects, and many are liable either to intentional or unintentional adulteration and substitution, it becomes necessary to give each lot of drugs received careful inspection. These examinations are made by the botanist in charge, and, in cases of the least doubt, literature giving the physical appearance of the drug is consulted; the herbarium sheet specimen is used, and, if the material be leaf, flower, fruit, or herb, it is easily proven to be false or true. After identification, the drug is further examined as to its physical condition, compared with the standard jar specimen, and, if found to be in proper condition, labeled and passed into stock.

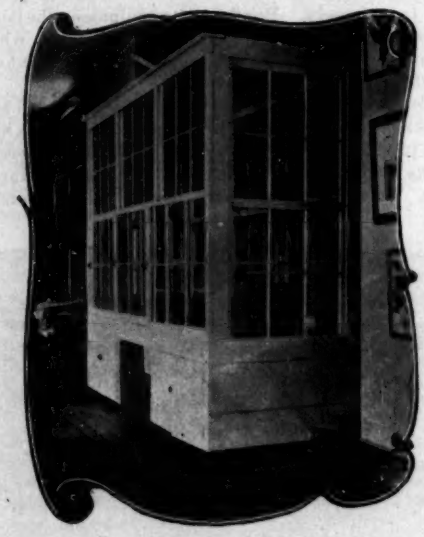
In all this work the herbarium has a constant use and is essential to careful examination of many drugs. It is highly valuable in the detection of substitutions and adulterations, and in many cases is the only means by which the determination of these sophistications is rendered possible. While it is important to know of a substitution or an adulteration, it is almost equally important to know of what it consists. Were the herbarium less general in its character, including only recognized medicinal plants, a great part of its usefulness would be destroyed, as only by careful comparison can some vegetable adulterants be located

in their proper genus or species, the parts being generally too fragmentary for using ordinary methods of determination.

Many drugs are received, the physical appearance of which alone is not a safe criterion for verification; barks, leaves, stems, and roots often arrive in a crushed and broken condition, which renders it very hard to tell whether or not they are what they purport to be. In such cases the appeal is to the microscope, and here an outfit for histological work has its use. Sections are prepared; the cell-structure and arrangement of tissues almost unerringly reveal the identity of the material. A set of slides of the officinal parts of plants has been commenced and will form a valuable part of the laboratory's equipment.

In the examination of powdered drugs, the compound microscope is indispensable; crystals, starch granules, and fragments of cells often betray adulterations at a small outlay of labor. In addition to the use of the microscope in drug inspection, it is a necessity in investigation along the line of pharmaceutical botany.

Interesting and practical results are expected from the cultivation of medicinal plants in the propagating case. Medicinal plants are grown from the seed with the purpose of learning more about their life history; seeds of adulterants are germinated



PROPAGATING CASE.

in hope of ascertaining the origin of the adulteration, and other work of similar nature, relating to pharmacy, is in progress.

Correspondence relating to botanical origin of drugs and plants, which arises in connection with business, is attended to by the botanist in charge, and in this work the laboratory is of much service.

Daily practical demonstrations are seen of the use of a botanical laboratory in connection with the trade. As an aid in the examination of drugs alone the laboratory finds its existence justified. As a means for investigation, it has great value, and through such means alone can some things, very important to the trade, be worked out.

The discoveries and determinations of adulterations of jalap, cubebs, Arnica flowers, Calendula flowers, and many other important drugs was only possible because botanists worked upon them; it cannot be said to have been otherwise, as pharmacists who have made these discoveries have had botanical training, used botanical methods, and succeeded in so far as they were good botanists.

The laboratory referred to in this article was founded primarily to provide accurate and scientific means for determining plant products used in manufacture; the acquisition of an herbarium which includes representatives of families and genera not medicinal, the provision for plant culture, histology, and microscopy is in recognition of the fact that botany in a broad sense has a direct and practical bearing on pharmacy.

ON THE EMERGENCE OF A SHAM BIOLOGY IN AMERICA.

BY CONWAY MACMILLAN, UNIVERSITY OF MINNESOTA, MINNEAPOLIS, MINN.

THOSE whose attention, during the past fifteen or twenty years, has been directed towards the various phenomena attendant upon the establishment and modification of university *curricula* will scarcely have failed to notice, in certain quarters, an interesting eructation of courses in biology. Upon even a casual examination these courses, in almost every case, turn out not to be courses in biology at all, but courses in zoölogy masquerading under an attractive but deceptive name. Chairs of biology occupied by men practically ignorant of one-half of the content of the science they profess to teach are not unknown in institutions otherwise altogether reputable. This ignorance of theirs is not merely the normal failure to push beyond the beach-line of the great unknown ocean of truth, but is a failure to comprehend or admit that the ocean extends away equally in both of two directions rather than in one alone. When one remembers how intolerant are most men of liberal education when they discern through the thin veil of pretence the deformity which it tries to hide, it seems remarkable that more vigorous protests have not already arisen against the sham biologist and the sham biology. It is because the writer believes that opportunities for a development of the true biology are lost, sometimes, through the mistaken acceptance of the sham, that he ventures upon the unpleasant task of pointing out what, after careful examination, seem to him the places where the healing cautery should be applied.

First of all, it is important to note what should be the proper limitation of the term "biology." Historically and etymologically it is still to be defined as by Lamarck and Treviranus — both distinguished botanists — who invented it. It is indeed the science of living things; it is that vast mass of knowledge bearing upon the organized world of plants and animals. Biological science is therefore to be set over against physical science in the broadest sense, and is to be considered as a generic name, under which are grouped the specific sciences of botany, zoölogy, and doubtless also psychology, if that is to be considered as co ordinate with zoölogy rather than as one of its subdivisions. Here, then, is the proper definition: "Biology is the science of living things." These are the two groups of subject matter: Plants and animals.

In Germany, and sparingly elsewhere in Europe, a limited and secondary meaning is imparted to the word "biology." Of this use an excellent example is furnished by Wiesner,[1] who groups together the various phenomena of inter-relation between plant and environment under the name of *Pflanzenbiologie*. To this restricted use of the term, Strasburger[2] very properly objects, characterizing it as "fälschlich bezeichnet." This employment of the term, as if it were synonymous with Œcology, does not, however, seem to be prevalent in America, where is to be found the third and most misleading use of the word — as generally exclusive of botany and sometimes also of zoölogy. For example, at Columbia College their exist together departments of botany and biology,[3] and, upon examination of the courses offered in "biology," it appears that they are almost purely courses in animal biology, and indeed this modified term is quietly brought forward in a foot-note. At Columbia College, then, it is apparent that the subject of botany, since it stands by itself under its own organization, is supposed, at least by the "biologists" of that institution, to be quite without the pale of their own science. And a further examination of the circular shows that the biological work is in the hands of zoölogists, both the professor-in-charge and the adjunct-professor being known to the scientific world only through zoölogical research and not through botanical.

The department of biology, then, at Columbia College seems to the writer to have false colors flying at the mast-head.

It is concerning the false use of the word "biology" in some American institutions that I wish particularly to speak. I have

[1] Biologie der Pflanzen, Wien (1889).
[2] Bau und Verrichtungen der Leitungsbahnen, vorwort viii., Jena (1891).
[3] Columbia College Circular of Information, Pt. iv., pp 44-45 (1892-93).

not at present time to discuss the fundamental absurdity of courses in "general biology"—as if it were possible to plunge boldly into comparative study of plants and animals before one has studied plants and animals themselves. It is as if one should enter upon analytical statics and follow it up by geometry and the calculus. The peculiar badness, upon the botanical side, of all so-called text-books of general biology is sufficient to emphasize the point—at least upon the minds of botanists. It is, indeed, impossible to write anything of value upon any subject in which one is not somewhat of a specialist, and the inability of zoölogists to say something worth reading upon the anatomy of *Pteris*, for instance, is not at all to their discredit, but merely marks them as of common flesh with the rest of mankind.

Harvard University is probably the innocent cause of the biology heresy which of late years has spread over the country. With that openness of vision and clearness and accuracy that has from early days characterized what, in biological lines, must be universally recognized as the first institution in America and one of the first in the world, there has not yet appeared any trace—that I am aware of—of the false or sham biology. The two sister-sciences of zoölogy and botany, each splendidly equipped both in the matter of laboratories and libraries, and men, have there developed side by side, as have physics and chemistry in most of the American universities. Botanical science, especially, with its millions of capitalization, has found a congenial home at Harvard. And precisely here seems to have been the difficulty. The endowment, the gardens, the laboratories, the museums, the libraries, the men were not to be easily had by any new institution that might spring up. And yet if the new institution were to be ambitious, it could not willingly see itself in a confessedly subordinate position. How then, without the lavish expenditure of wealth, was the dilemma to be faced?

One finds in the register of a well-known Maryland university[1] a confession of the truth concerning botany, where it is stated, "a third permissible line of specialization commencing at this stage, namely, botany, has always been contemplated since the organization of the biological department, but as yet is not available because of lack of money." While frank confession is held to be good for the soul, it is not certain that higher moral value would not have attached to an honest naming of the zoölogical courses that *were* provided for.

This acknowledged inability of Johns Hopkins University to provide a well-balanced course in biological sciences, together with the unwillingness of that institution to expose her weakness has led to much of the sham biology work that springs up from time to time over the country. The so-called department of biology there is manned by zoölogists, and the men who graduate—many of them honestly enough mistaken—are ready to take upon themselves not the name that belongs to them but that of "biologist." An interesting example of the large views of biological science which may develop in the Johns Hopkins doctor of philosophy lately came under my notice and has some illustrative value. A certain "biologist," some time since, published a pamphlet supposed to convey information concerning biological instruction in America. I do not know what the zoölogists thought of it, but it received a very chilling reception at the hands of the botanists.[2] On account of the particularly shabby treatment accorded the botanical work of the University of Minnesota, I took occasion to administer a mild rebuke to the author of the pamphlet. In reply I was assured that, while he had studied at Johns Hopkins University, he had learned that botany was of value "for teaching children." The cool effrontery of this would have surprised me had I not known the marvellous, sometimes continuous, sometimes sporadic, always insular capabilities of the Johns Hopkins biologist for blatant philistinism in regard to things botanical.

Were it not for the injustice worked upon young men attracted by such wrecker-light use of the word "biology," and, hopelessly injured in their conceptions of what they suppose to be their specialty, it would be far from my thought or wish to draw attention to any weakness in an American university. All know that the struggle for existence has its meaning even for the universities as for other organisms But protective mimicry in a university curriculum is not a pleasing phenomenon. In this particular case too much is at stake, both for the botanist and for the zoölogist, to make science the virtue that it generally is. In days of sharp specialization, such as those in which we live, it must be a source of regret and alarm to well-balanced zoölogists to see so many of those who might be ornaments to their profession led astray by a will o' the wisp chase after the unattainable. Better far to be a respectable zoölogist than a biologist with only one cerebral hemisphere. And the botanists, too, seeing what delusions may gain currency, are dismayed at the spectacle of some distinguished zoölogist perpetrating a confidence-game upon a board of trustees, assuring them that he proposes the establishment of a biological department, and then appearing with little more than mere zoölogy. The most alarming thing of all, both to zoölogist and to botanist, is that, after successfully establishing a school or department of zoölogy under the false name of biology, it should be possible for the mental vision of the founders to become so curiously warped that they will insist with vigor and with all the air of a righteous enthusiasm that the school or department actually *is* biological and that instruction really *is* given in biology. For, to the zoölogist, this must indicate one of two things, either that his *confrere* is unable to comprehend what biology is, or that he is ambitious, in regular old-style, eighteenth-century regardlessness, to announce himself a polymath, and therefore, perforce, a smatterer. And, to the botanist, it indicates the willingness of the "biologist" to make use of means that cannot with self-respect be duplicated by himself in the pushing forward of one line of biological science at the expense of the other.

Fortunately, in America the sham biology has as yet an uncertain foot-hold. At such institutions as Harvard, Pennsylvania, Cornell, Michigan, Minnesota, Leland Stanford, it has no standing. The only critical point which need be particularly considered at present is the new Chicago University. Here one sees again the anomaly of an able animal morphologist announced in the *Programs* as a professor of biology, and one's suspicions are aroused that the same sad blunder is to be made in the west which has already disfigured the biological work of at least one eastern institution of learning. In the announcement of biological work,[3] one finds an exceedingly fair presentation of the illogical character of a "school of biology," and the promise is made that in a few years the school will probably be broken up into several departments. The definition of biology is offered, and one finds it unimpeachable. Apparently, however, there is even here a danger, for, when one turns a page or two, it appears from the classification that botany is held to be co-ordinate with neurology or animal physiology, rather than with zoölogy in the broadest sense. This error in classification is perhaps an inadvertency and perhaps a natural enough one-sided grouping, such as might perhaps be expected of some specialist in a botanical line if he were to try his hand at the organization of a school of biology with zoölogy "not yet provided for."

It is probable that, after all, the better way to develop well-balanced departments in biology is to place the task in the hands of both botanists and zoölogists rather than in the hands of either. There will then be scarcely so much danger of narrowness of view impeding the freest and best evolution. At any rate, this is the plan which has succeeded so brilliantly at Harvard University, and the other plan is the one that has failed so grievously at Johns Hopkins University. It will be a matter of regret if Chicago is really willing long to preserve the present unfortunate attitude, for it must be confessed that the instruction now offered there under the name of Biology is, after all, the half-science, the sham biology.

I make the point that, for educational purposes, "biology" is either a superficial smattering of natural-history facts and methods—and in this case not of any value—or a strong, uniform presentation of the facts both of botany and of zoölogy—and in this

[1] Johns Hopkins University Register, 1891-92, p. 113.

[2] Botanical Gazette, editorial, vol. xvii., p. 260.

[3] Programme of Courses in Biology, University of Chicago (1892-93).

case a very different thing from a sham biology which is principally, or all, zoölogy.

THE AURORA.

BY W. A. ASHE, F.R.A.S. (RETIRED), QUEBEC, CANADA.

SOME notes resulting from a study of the Aurora extending over many years, and pointing out how some of the better known theories fail to account for known conditions of the phenomena, may interest the readers of *Science*.

I regret, that after having endeavored to show how the present theories fail, that I have no theory of my own to advance. I have done a good deal of theorizing on different subjects, at intervals in a somewhat busy life, so that there are few who have a better opportunity of knowing how deceptive evidence is which is *sought for* to support a theory; in other words, how faulty—yet how plausible—the result, when the observed facts are (unconsciously) made to fit the theory, instead of the theory the facts. Argument with such a theorist is futile. To use Professor Swift's words, in *Science* of Dec. 9, "... auroræ frequently occur when no spots are visible on the sun, ... sun-spots are often seen when auroral exhibitions ... are entirely absent, ... the advocates of the theory ... answer to the former, that sun-spots *may* have been on the *other* side of the sun, and, to the latter objection, that there *may* have been auroræ visible in the Arctic or Antarctic regions, or in both." I do not credit those who pin their faith to a connection between the two classes of phenomena, with having to go so far for an excuse, as they generally utterly ignore the want of coincidence, and instead of discrediting their theory (and I need not add that one failure should have very many times greater weight than one coincidence) calmly ignore it, and proceed with their cumulation. I do not wish to be understood as thinking that there are not dispassionate investigators in this matter; I am only pointing out what I believe to be a very common human peculiarity, and one which I believe does much harm in so far as permitting of the propagation of theories which had else died, still-born, on their authors' hands.

"The evidence of the correctness of a theory or hypothesis increases with the number of facts it is capable of satisfactorily explaining. It diminishes with the number of facts it does not explain, and with the number of different ways in which similar phenomena can be explained. A *single fact*, inconsistent with any theory or hypothesis, is sufficient to overthrow it," is a statement of fact that will be most useful to us in theorizing, and serve to measure some existing theories with.

Any theory of the Aurora must account for the following, amongst other, peculiarities, which seem to me to be characteristic of the same. A. —That they most frequently occur in the colder half of the year, being limited, approximately, by the same isothermal lines as far as the southern limit, in the northern hemisphere, of their visibility is concerned, and not depending in this on latitude. It would seem, then, that temperature is a factor in the required theory. B. —Auroral displays do occur in the summer season, when their situation is more equatorial, and, perhaps as a rule, they cover a larger area than the average winter display. It would seem, then, that on the transference of the maximum winter displays from one hemisphere to the other, these displays may take place in intermediate situations. C. —From my experience in these latitudes, summer displays of limited extent seem to be concurrent with a drop in the temperature considerably below that corresponding to the average of the date in question. D. —My experience has been that auroral displays do not occur during generally unsettled weather, requiring (although the particular locality of the display may be largely overcast, permitting only of the aurora being seen behind the clouds or through the interstices) that generally elsewhere the weather should be clear. As though clouds on the horizon of the display (*not* of the observer) intercepted the influence producing the same. E. —The typical aurora, from which are many departures as pointed out by Professor Swift in the communication mentioned, is a narrow circular arch in that part of the heavens away from the sun, the concave side of which is usually well defined, and beneath which is absolute darkness, into which streamers *do not* descend; the convex side of this arch is, generally, illy defined, from which streamers proceed and the light of which is very much less intense than that of the concave side; conveying to me the impression of the light, the visible effect of the influence, being completely cut off by the interposition of the solid mass of the earth, it being assumed to be the intercepting horizon at the altitude of the display. F. —(Speaking still of the typical auroral arch). It is on the lower and brighter side where the greatest horizontal movements and the greatest contrasts in the intensity of its light (forming, amongst other outlines, so called "curtain-folds") are seen. As though at the horizon of the display, our atmosphere, acting as a lense, concentrated the light (the visible effect of the auroral influence) in just such a way as a spherical, atmospherical, lense would, having its centre "stopped" out by such a body as our earth, in which the densest part being next the earth, the greatest relative variation in its homogeneity would exist and the greatest variation in the transmitted light (the visible effect of the auroral influence), resulting in just such movements as we have seen in the typical arch. G. —It has been constantly noted, that two or more observers, situated, say, 100 miles apart, view occasionally, if not always, totally distinct auroral outlines, differing, at times, radically; so that one observer may report a display differing entirely in class and details from the other at the same instant, or even reporting the entire absence of a display when the local conditions were such as would have permitted its being seen had it existed. From this, it appears to me, we must conclude that the light (the visible effect of the auroral influence) has no material existence in that part of the heavens in which it is seen, else, all observers, so situated on the earth that the point of display is above their horizon and this particular point not obscured by clouds, should see the same display, modified only in detail owing to the effects of perspective attributable to the different points of view. H. —There is an intimate relation between the aurora and magnetic storms; not sufficient to permit of our concluding the one is Cause and the other Effect, but sufficient, I think, to permit of the supposition that both are Effects of a common Cause. These appear to me to be some of the more self-evident peculiarities of the typical Aurora.

The theory in connection with the aurora which appears to have the greatest hold on the investigator and the general public, is one which supposes a connection between these displays and certain disturbed—sun-spot—areas of the sun. If one were to accept the evidence that is brought forward to support this supposition, without taking into account the evidence which has, unintentionally, been suppressed, or perhaps it would be better to say, "not advanced," it would be a very hardened sceptic who would not admit that this question had been settled for all time. In *Astronomy and Astro-Physics*[1] it is concluded that auroral displays recur at intervals which exactly correspond with that of the solar rotation, and at the instant when this disturbed area is at the eastern "limb" of the sun. Dropping for a moment the discussion of the cumulative evidence, it is interesting to note the peculiar nature of the force which proceeds from the solar area in this case. If this influence is at its maximum on the appearance of the area on the eastern limb, and not continuous to the western limb, it is evident that the maximum effects are produced horizontally and in one direction only from the sun's surface. It is not impossible that this is so, but it is an unfair assumption to make, apart from any knowledge of a similarly acting force in nature, and in direct opposition to what experience, in other matters, would suggest as the direction in which such a source of energy would produce maximum results. As to the fact of maximum auroral displays occurring at the instant when the disturbed solar area has reached the eastern limb, the coincidence cannot be as great as claimed, or else the occasions on which this has happened have been given undue prominence in collecting facts to suit the theory, for in a communication to the Royal Astronomical Society[2], the Astronomer Royal states, in

[1] Reprint No. 118.

[2] "Monthly Notices," March, 1892.

discussing sun-spots and associated magnetic disturbances over the period 1880–92, "Most of these magnetic disturbances occurred when an exceptionally large spot was visible on the sun near the centre of the disc, or about the time of some great change in a sun-spot." It should be quite evident, then, that this marvellous coincidence between certain positions of the disturbed solar surface and auroral displays is, to say the least, not such a hard-and-fast rule as the exponents of the theory claim. Even did we admit that the evidence put forward was not as discordant as pointed out, and accepting the statement that, "Under the physical conditions existing in interplanetary space" (a matter admitting of considerable discussion even yet), "cosmical dust and debris, there sufficiently abundant to shine by reflected sunlight as the zodiacal column, furnish a conducting medium well fitted to convey by induction these solar electro-magnetic impulses to vast distances."[1] The single fact, as explained under section "G," that different observers see unlike auroras at the same instant at their several points of observation, is conclusive proof, to my mind, that this "cosmical dust and debris," either without or within our atmosphere, have not been made luminous by the conveyance of the "solar electro-magnetic impulses," as the visible aurora under this theory would require.

NOTES AND NEWS.

A PRINTING Exposition is to be held at the Grand Central Palace, New York City, from May 1 to June 1 next. It is intended to show, by object lessons on a magnificent scale, the history, and progress of the printing trade since the establishment of the first press in this city 200 years ago by William Bradford. The aim is to show in operation the first rudimentary press, and the latest perfected web press; also type-setting and moulding, electrotyping, stereotyping, and photo-engraving processes, color work, etc.

— Professor J. Mark Baldwin of the University of Toronto has accepted the position recently offered to him as Stuart Professor in Psychology in Princeton University. A suite of rooms in North College have been set apart for a laboratory for experimental psychology, and a liberal appropriation made for its equipment in time to begin work next September. Professor Baldwin intends to offer advanced courses, both graduate and undergraduate, in all the departments of psychological work.

— An interesting discovery of the rare trout, *Salvelinus oquassa*, in a mountain lake in the vicinity of Ottawa, Canada, the capital of the Dominion, is recorded in the last number of the Ottawa *Naturalist*, by Mr. J. F. Whiteaves, zoölogist of the Geological Survey. *S. oquassa*, the blue-backed trout, sometimes called the "Rangeley Lake Trout," is stated by Jordan and Gilbert ("Synop. Fishes N. America," 1883, p. 318) to be the smallest and handsomest of our trouts, and as yet known only from the Rangeley Lakes in western Maine. In 1891, Mr. V. C. Nicholson of Ottawa visited a small lake known as Lac de Marbre, lying in the Laurentian Hills, in the Township of Wakefield, Province of Quebec, a few miles from Ottawa. He noticed the difference between some trout he there took and the ordinary brook trout (*S. fontinalis*) which occurred plentifully in adjoining lakes and streams. Mr. Nicholson was so impressed with the fact that these were of a different species that he procured a living specimen, which is now to be seen alive in one of the aquaria of the Government Fisheries Department Exhibition at Ottawa. The specimen was referred to Mr. Whiteaves, who determined it to be the above species. The occurrence of this rare fish in Canada will be of interest to ichthyologists.

—Mr. G. W. Lichtenthaler, one of the most earnest, energetic, and eminent of American conchologists, died at San Francisco Feb. 20. For twenty years he has done nothing but travel and collect, and his vast collection embraces 6,000 or 8,000 species of shells, 1,000 species of marine algæ, and 500 species of ferns, besides many thousands of duplicates. This entire collection he bequeathed to the Illinois Wesleyan University at Bloomington, Ill., the city which has been his home for most of his life. In addition to this valuable collection he bequeathed $500 to put it in suitable shape for preservation. This gives the Illinois Wesleyan University one of the most valuable conchological collections of the country. The ferns and algæ are from every part of the world, and the ferns have a complete collection of those of the Sandwich Islands, and nearly a complete collection of those of North America. The entire collection will be arranged as speedily as possible, and will be accessible to all students of the subjects, as well as to others.

— The series of Saturday lectures, complimentary to the citizens of Washington, given for some years under the auspices of the Philosophical, Anthropological, and Biological Societies of Washington, was discontinued two or three years ago. It is now proposed to resume the series under the auspices of the Anthropological Society, and to arrange the lectures in such manner that each course will serve as a logical introduction to the study of the Science of Man in some of its various aspects. The lectures will be delivered in the lecture room of the U. S. National Museum, at 4.30 P.M., on the dates specified. Citizens of Washington and their friends are cordially invited to attend. The course provisionally fixed for the present season (1892–'93) of the Anthropological Society is as follows: Saturday, Mar. 25, The Human Body, by Dr. D. S. Lamb; Saturday, Apr. 1, The Anthropology of the Brain, by Dr. D. Kerfoot Shute; Saturday, Apr. 8, Status of the Mind Problem, by Professor Lester F. Ward; Saturday, Apr. 15, The Elements of Psychology, by Major J. W. Powell; Saturday, Apr. 22, The Earth, the Home of Man, by W. J. McGee; Saturday, Apr. 29, The Races of Men, by Dr. Daniel G. Brinton; Saturday, May 6, The Evolution of Inventions, by Dr. Otis T. Mason; Saturday, May 13, Primitive Industries, by Thomas Wilson.

— In the summer of 1892, courses of instruction were offered by professors and instructors of Cornell University in botany, chemistry, mathematics, philosophy, physics, English, French, German, drawing, and physical training. The Summer School has now been made an integral part of the university, and, for the summer of 1893, courses are offered in the following subjects: Greek, Latin, German, French, English, elocution, philosophy, pedagogy, history, political and social science, mathematics, physics, chemistry, botany, drawing and art, mechanical drawing, and physical training. Without excluding others qualified to take up the work, these courses are offered for the special benefit of teachers. They afford a practical scheme of university extension, by which the teachers themselves are taught under university instructors, by university methods, and with access to university libraries, museums, and laboratories. The courses are open to women as well as to men, and the same facilities for work are extended to these students as to the regular students of the university. The amount of work implied in these courses is so great that students are advised to confine their attention to one or two subjects. Opportunity will be given for original research under the guidance and with the assistance of members of the instructing corps. Inquiries regarding these courses should be addressed to those in charge of the several departments. The Sage College for Women, a spacious and well appointed dormitory on the university grounds, will be open during the session of the Summer School to women students and to gentlemen with their wives. Inquiries regarding board and rooms may be addressed to Professor Geo. W. Jones; or applications for board and rooms at Sage College, to the manager, Mr. E. P. Gilbert.

— Messrs. D. Appleton & Co's list of spring announcements includes "The United States," by Elisée Reclus, which forms the third volume on North America in Reclus's great work, "The Earth and its Inhabitants;" "Appleton's Annual Cyclopædia for 1892," which will be issued immediately, and, like Reclus, is sold by subscription; "The Principles of Ethics," Vol. II., by Herbert Spencer; "The Laws and Properties of Matter," by R. T. Glazebrook, a new volume in the "Modern Science Series"; "Appleton's Guide-Book to Alaska and the Northwest Coast," by Miss E. R. Scidmore, which will be uniform with "Appletons' Canadian Guide-Books."

[1] Reprint Astronomy and Astro-Physics, No. 113.

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Attention is called to the "Wants" column. It is invaluable to those who use it in soliciting information or seeking new positions. The name and address of applicants should be given in full, so that answers will go direct to them. The "Exchange" column is likewise open.

EARTHQUAKES IN AUSTRALASIA.

BY GEORGE HOGBEN, M.A., SECRETARY SEISMOLOGICAL COMMITTEE, A.A.A.S., TIMARU, N. Z.

SEISMOLOGY is a branch of science that until quite recently received very little attention in Australasia. This could hardly be said to be due to the lack of phenomena; though, with one or two exceptions, the earthquakes that have taken place, even in New Zealand, — the seat of the worst disturbances, — have been very mild in character. The stimulus the subject has received lately was given by the Australasian Association for the Advancement of Science, an association which has done so much in other departments to encourage systematic scientific work. As one of the research committees, the A. A. A. S. appointed a committee to report upon seismological phenomena in Australasia; and I think I cannot make a better beginning of what I have to say on the subject than by setting forth in brief the work this committee is attempting to do.

In the first place it has set itself to compile a list of all recorded earthquakes (within the area of its investigations) up to the present time, including in that list all the important details as far as they are given in the existing records.

In the next place we have attempted to provide for the future recording of earthquake shocks in all the colonies according to a uniform system. These records include, among other details, the exact time of the beginning of each shock, the time being checked by the standard telegraph time of each colony through the medium of the Public Telegraph Departments.

Inasmuch, also, as it is, to a large extent, as part of a world-system of observations that our observations in Australasia may become useful, we propose to do for the islands of the Pacific, as far as circumstances will admit, what is being done for the Australasian colonies. There, of course, exact time-observations are generally out of the question; but with the aid, already largely promised, of missionaries, consuls, and other residents, much more, we trust, will be done than at first appears possible.

To secure uniformity in recording the intensity of earthquakes, the Committee have adopted as a common standard the Rossi-Forel scale of intensity. Though rough and variable to a slight extent, it has the advantage of being a recognized standard and is suited to the nature of the evidence at our command.

The materials obtained are used, where sufficient data are to be had, in the determination of the origins of the shocks. In many cases the epicentrum and velocity of propagation can be found; and in a few instances the facts are sufficient in number and accuracy for a more or less probable determination of the depth of the centrum or actual source of disturbance. With the advantage of easy reference to a standard time in most parts of the Australasian colonies, and with increased experience and skill on the part of the observers, it is hoped that accurate observations may become more and more common; in fact, in New Zealand, where the present system has been in use for three and a half years, we find that this is the case. It is true that we have very few seismographs; but the great value of time observations based upon a universal standard time has been fully shown by Major Dutton in his report upon the great Charleston earthquake of August 31, 1886, and his conclusions in that respect are fully borne out in our experience.

The want of special instruments cuts us off from any direct means of determining the amplitude and intensity of the shocks; but the field of research already indicated will give us enough to do for some time to come.

If it be asked what we expect to accomplish by our investigations, I reply that any general theories relating to earthquake phenomena must be based upon observations in all parts of the world, and we aim at making our work of sufficient value to count as a part — only a small part, perhaps — of the materials required for solution of many of the interesting questions arising out of, or connected with, seismology. For example, the nature of the interior of the globe, whether solid or liquid, or solid but potentially liquid, — a problem discussed in such an interesting manner by Osmond Fisher in "The Physics of the Earth's Crust," — would receive considerable light from the determination of the depth of earthquake-origins. If no earthquakes, let us suppose, could be shown to come from a greater depth than twenty-five miles, we should have a strong presumption that at about that depth there was a great change in the condition of the interior; and with a very large number of instances we might have something like a proof of such a break in continuity. The physicists have been at war over this point for some time, and without undue conceit we may say that a definite solution is at least as likely to come from seismology as from any other branch of physics.

In another paper I hope to give a short account of the results already obtained from our observations in this part of the globe. I trust, however, that the editor will allow me to say here that I shall be very glad to communicate with or receive hints from any one engaged in seismological work in America (North or South), especially with reference to earthquakes occurring on or near the coast of the Pacific.

THE PREFIX AQ- IN KITONAQA.

BY ALBERT S. GATSCHET, VINITA, INDIAN TERRITORY.

UP to the present only two scientists are known to have studied seriously the Kootenay or Kitonâqa language, which is spoken by about one thousand Indians in northwestern Montana and in the adjacent parts of British America. These two investigators are Dr. Franz Boas and Dr. A. F. Chamberlain; both have collected a large amount of lexical material and a considerable body of ethnological texts. Chamberlain's report on the tribe and language forms one fascicle of the publications of the British Association for the Advancement of Science, which contains the Transactions of the Edinburgh Meeting of 1892, and is entitled, "Eighth Report on the Northwestern Tribes of Canada," with preface by Horatio Hale (octavo, pp. 71).

The prefix âq- plays a great part in this northern language, for the large majority of the substantives, many particles, and other terms begin with it. The q- is pronounced like the Spanish j and the German ch in *lachen*. It appears from Chamberlain's long list of the substantives begining in âq-, that this prefix should really be spelt âqk-, for -k is always following the first two sounds.

These two sounds easily combine with each other in many of the Indian languages. In Peoria and Cheyenne the k- alternates with qk-, and in Tonica of Louisiana every k- may be spelt qk- as well, for this is simply an "expansion" of the simple sound k-. Chamberlain ventures no derivation or explanation of this prefix, and Boas is also doubtful concerning its origin.

There is a linguistic family in Oregon, the Kalapuya, the dialects of which show exactly the same peculiarity concerning the substantive nouns. In the Atfálati dialect, once spoken near Gaston and Wappatoo Lake, west of Portland, almost all substantives begin with a-, as apúmmeig, *woman*. Among the few exceptions, I now remember only mántăl, *dog*. All adjectives of Atfálati begin in wa-, u-a-, ua- in their form for the singular, and this coincides exactly with the radix of their numeral for *one*. Although what we call *articles* do not frequently appear in American languages, the proclivity of these to agglutinate with their nouns is a well-known fact though more so when the article is suffixed than when prefixed to the noun. *cf.*, the Dakota, Otomi, Basque, and Scandinavian. In the Chonook jargon the French article *le, la* was by the Indians fused into one word with the noun following: Lipipan, *le ruban;* liblō, *le bleu*, or purple; lilu, *le loup*. Thus I argue that the Atfálati numeral for *one* became an indefinite article *a* and was coalescing with the noun following it into an inseparable unit.

The same thing occurred in the case of the Kitonăqa prefix ăq-, ăqk-. We find it, though pronounced somewhat differently, as o'kē, ō'kwē, *one*, the first numeral. *cf*, aiwōm tla ō'kwē, *ten and one*, viz., "eleven;" in what Chamberlain calls the independent form of the substantive and adjective, which through this addition differs from the form as used in composition; tlŭ, *snow*, ăqktlū (independent form). The same radical also occurs in ăqktō, *bear one year old;* aqksăkes kō'kwes, *one leg;* ă'qkĭ, *and, again, more* (perhaps "one more" originally).

I therefore consider this prefix as an obsolete indefinite article, which has gradually fused into one solid body with the noun following; we are at leisure to consider it now as a definite or an indefinite article in its original state. It was once *an article* and is now fossilized, like the a- of the Kalapuyan dialects, into the body of the word.

MAMMOTH CAVE IN MARCH.

BY H. C. HOVEY, D.D., BRIDGEPORT, CONN.

I HAVE long been curious to see the great cavern amid wintry surroundings. The capricious season is not without charms to one who can appreciate nature's changing moods. As our train pulled out from Louisville we saw that the tumultuous yellow flood had wholly obliterated the falls of the Ohio, as well as the costly canal around them, and had inundated the broad flats by the great bend below to a breadth of twenty miles. The storms of rain and snow swept over the Kentucky hills that guard the line of the Louisville and Nashville Railroad, but could not wholly hide the rugged grandeur of their naked crags and pointed peaks; while the torrents, rolling southward between bright-red ocherous banks, were far more interesting than their dry courses could be in sultry August. There are said to be five hundred caves in Edmondson County, and several of these are lauded by their owners as rivals to Mammoth Cave. This petty jealousy cropped out in the remarks made to us on our arrival at the Glasgow Junction, where we had to change cars, to the effect that Green River had broken into Mammoth Cave so as to make its avenues impassible; that visitors were not admitted at this season; that the hotel was literally dropping to pieces and had been closed; and, in short, that we had better turn our steps in some other cavernous direction. This local jealousy has occasionally even taken the malignant form of wanton injury to the estate and ugly threats of violence to the manager. Whenever a grander cavern than Mammoth shall actually be discovered (which may sometime be the case), let its claims be allowed; but thus far it stands as the noblest specimen of its kind. As such it has an interest for all patriotic Americans. True, our interest is weakened slightly when we find ourselves taxed fifteen cents per mile on the Mammoth Cave Railroad — a tariff never relaxed by the Nashville company even for excursion parties of hundreds of passengers; and it is further impaired on finding the ancient hotel, if not literally dropping to pieces, yet far from luxurious, or even thoroughly comfortable. It is a great architectural curiosity as having been evolved from a log-cabin germ planted in 1812, but it fails to meet the demands of the modern travelling public. While admiring the good taste that keeps the surrounding forest intact in its native wildness, we should appreciate better walks by which the woodland charms might be made more accessible. We would also respectfully remark that these are days when electric lights are quite generally used, in preference to lard-oil lamps, and nowhere would they be more serviceable than in illuminating the grand subterranean realm of Mammoth Cave, as has long been done at Luray. It is our conviction that the owners of this splendid estate could make no more remunerative investment than by the timely adoption of these friendly suggestions.

And yet justice should be done to the improvements already made by the enterprising manager, Mr. H. C. Ganter, about the hotel and grounds, and especially within the cavern itself. One of the first localities we explored on this visit was Audubon Avenue, the first right-hand branch from the main cave, which when we last saw it was heavily encumbered throughout with great fragments of limestone that made the going very tedious. These have all been removed at great expense, some of them being dumped into a deep ravine, and others piled up in formidable, yet shapely, walls. One object of all this is to prepare the way for the practical cultivation of mushrooms on a scale equal to that at Frèpillon and Méry, in France. Over $5,000 have already been spent in this work under the direction of skilled gardeners, and ultimate success is looked for. Another striking change accomplished recently is the opening for the public of what is to be known henceforth as Ganter Avenue, and which has hitherto been passable only for the guides and hardly for them. It is a wonderful fissure, or rather series of fissures, extending through solid limestone for 8,500 feet, as actually measured by us. The passage, until recently widened, used to be for a great distance only about eight inches wide. But by patient drilling and blasting it has been enlarged so that persons of ordinary size have no serious difficulty in going through. Indeed, it has already been threaded by perhaps a thousand visitors. It twists and winds in the most curious manner, more than two hundred turns having been actually noted, and it is well worth seeing for its own sake. But the main advantage derived from it is that when River Hall is flooded, as it is liable to be during more than half the year, tourists can thus gain the crystalline regions beyond and reach the extreme end of the "long route;" and should they ever be caught there by a sudden rise of the waters, they have this safe way of exit always available. At the time of my visit Echo River, Lake Lethe, the Styx, and the Dead Sea were all united into one vast body of water, extending from Bacon Chamber to Cascade Hall, its depth from surface to bottom being at least 100 feet; and the water was backing up into Gorin's Dome, the Bottomless Pit, and all other pits in the cavern; but not a drop in Ganter Avenue, through which we safely passed to the regions beyond and returned dry shod. The temperature, both of the water and air, is uniformly 54° F. all the year round; the exceptions being in localities where a strong draft lowers the mercury a degree or two, or where the warm air from the lamps, fireworks, etc., gathers in close domes, whence it cannot immediately escape. On the whole, I do not hesitate to recommend Mammoth Cave as a delightful winter resort. The climate is salubrious always, and the sole difference in the cave itself from its summer condition is in the subterranean waters; and even here, if suitable boats were provided, guests might enjoy a charming sail, and they would find the passage-way over Lake Lethe endowed with the same marvellous echoing peculiarities that have made Echo River so famous. By the way, I have never heard mention made of the quite different but equally wonderful acoustic properties of the Chief City. This is an immense hall, 450 feet long by 175 feet wide (as measured by us) in which many Indian relics are found. Stationing ourselves at its opposite sides, as far apart from each other as we could get, we had no difficulty in conversing in ordinary tones or even in the very softest whispers, every faintest sound being faithfully carried across the hall.

It is not my object now to describe the familiar wonders of the great cavern, always the same, winter and summer, and that

have been described a thousand times. But I take pleasure in directing public attention to two adjacent caverns, belonging to the Mammoth Cave estate, and that are seldom visited, though each for different reasons should challenge admiration. The White Cave (so named eighty years ago on account of the whiteness of its formations) is entered at a point half a mile from the hotel. Its floor is cut by numerous channels, through which water runs so pure as to be almost invisible, leading to exquisite pools with ruffled and incurved rim, none of them being more than two or three feet deep. The roof is for the most part low and fretted with numberless dainty stalactites. Advancing, we find the floor encumbered with huge blocks of limestone, and the cave divided longitudinally by a wall of noble stalagmites far beyond anything of the sort to be seen in the adjacent larger cavern. It ends in a profound pit, named by us Bishop's Dome, for our guide, Eddie Bishop, who, so far as is known, was the first to descend to its bottom, which feat he accomplished in our presence. It is supposed that the White Cave is connected with the Mammoth Cave at some point near the end of Audubon Avenue, or possibly at Little Bat Avenue; but this remains yet to be proved.

For ten years past I have heard of Dixon's Cave, but had never been informed that it was in any way remarkable, except for having possibly been at some remote period the original mouth of Mammoth Cave, and even this seemed to be a matter of doubt. Being desirous of seeing it, simply for the sake of completing my work, I donned my usual cave attire, and sallied forth one March morning with Bishop the guide. Snow had fallen to a depth of four inches, through which the brave daffodils in the garden lifted their golden heads, while the more modest spring flowers that had been tempted to bloom too soon lay hidden under the wide, snowy blanket. The ice-laden trees glistened in the vernal sunshine. As we broke our way through the budding underbrush of the oak opening, tracks were visible of rabbits, foxes, and wild turkeys. After going thus for several hundred yards, we were confronted by a wide chasm in the hillside, into whose yawning gulf great moss-grown forest-trees had plunged headforemost. Creeping under or climbing over their prostrate trunks, we gazed awe-stricken into the mightiest cavern-mouth I ever saw. The whole cavern is a single hall, which, by our measurement, is 1500 feet long, from 60 to 80 feet wide, and from 80 to 125 feet high, gradually curving from southeast to due south; the dimensions being quite uniform from end to end and from top to bottom. The roof is decorated here and there by alabaster stalactites, and at the time of our visit it was also appropriated by myriads of hibernating bats, clinging in great clusters like swarms of bees. The floor was long ago gone over by the saltpetre miners of 1813, who had left the rocky fragments piled in what might be described as stony billows lying across the cave, each wave being 40 feet through at the base and rising 25 or 30 feet above the true floor. At the extreme end the mass of nitrous earth seemed not to have been disturbed, over which we climbed to the very roof, and amid whose nooks we diligently sought a way of access to Mammoth Cave. We did not succeed; but subsequent outside measurements satisfied us that we had reached within 60 feet of the desired goal, and that by suitable excavation the connection might be made. Before leaving Dixon's Cave, I stationed Bishop at the inner end, while I gained a point midway where I could see the white sunlight as it was reflected from the snow, and then had him ignite three Bengal lights. The effect was indiscribably grand as their brilliant illumination crept through the black darkness till it cast my shadow on the fainter sunlight itself, like a giant spectre, and finally blended with the outer light, thus enabling me to take in at a single glance the vast dimensions of what may be justly styled the most magnificent subterranean hall in the known world. On our return to the hotel, we made our way by the mouth of Mammoth Cave and saw it environed by trackless snow, its mosses and vines spangled with silver, and the wild, pattering cascade falling from the rocks above to the rocks below as it has done for ages. And, turning away, I echoed with all my heart the guide's naive exclamation, "I fairly love old Mammoth Cave."

LETTERS TO THE EDITOR.

**** Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.*

On request in advance, one hundred copies of the number containing his communication will be furnished free to any correspondent.

The editor will be glad to publish any queries consonant with the character of the journal.

Anatomical Nomenclature.

As the years go by the movement for a thorough and scientific revision of biological nomenclature gains in depth and strength, and we have every reason to believe that great and lasting benefits will accrue to science as the result of these attempts to increase the precision and fitness of our scientific language. Believing that every increment, however small, is a distinct gain if it only possess the qualities above mentioned, I propose the following modifications in anatomical nomenclature for the consideration of all anatomists interested in this important work.

In my paper on the vertebrate ear,[1] I brought out in considerable detail the two following considerations regarding the morphology of the auditory nerve and made certain suggestions looking to an improved nomenclature of these parts. In the first place it was shown that anatomists had not adequately recognized the true nature of the auditory nerve owing to the persistence of the older view of the nature of the auditory organ, which was regarded as a morphological unit. Such a well-defined unit could only be supplied by an equally well-defined (single) nerve. It was there for the first time proposed to recognize in our terminology the fact that the auditory nerve is composed of two very thoroughly separated parts, both as concerns their central ends and their peripheral origin.

In the second place it was brought out that these two parts showed certain important anatomical relations to two other cranial nerves from which these branches of the auditory had in all probability arisen during phylogenetic development. The names proposed are N. auditorius ramus utricularis and ramus sacccularis, or the utricular and saccular nerves, respectively. This nomenclature is based on a very extended study of the comparative morphology of the acoustic apparatus. These terms are superior to and in every way perferable to the other current designations such as N. cochleæ and vestibuli, or N. superior and inferior.

The terms, N. vestibuli and N. cochleæ, are ill-chosen, from the fact that the morphology of the "vestibule" and its parts as conceived by the anatomists who first proposed this term has no real existence. On the other hand, the term N. cochlearis is unsuitable, not to say inadequate, from the fact that this nerve is not solely a cochlear nerve since its trunk contains nerves to the "vestibule" as well, viz., the saccular and posterior ampullar nerves wherever these are not provided with separate foramina. The central relation of these two nerves is always with the mass of cochlear fibres in those forms possessing an enlarged cochlear apparatus, as well as in the more primitive condition of the auditory organ.

While engaged in reconstructing our anatomical nomenclature it is very desirable that we choose those terms which express the present condition of our knowledge and give promise of being adequate for the future as well, for, I take it, the recent movement for a betterment of biological nomenclature is dominated by the universal desire for as simple, short, and expressive a terminology as shall be adequate not only to the science as it exists to-day, but also to its expanded condition in the not distant future. None of these conditions are fulfilled by any of the terms yet applied to the ear-nerve except the two, utricularis and saccularis.

No broad-minded anatomist will desire to retain names in human anatomy that are inapplicable to all other vertebrates possessing the homologous arrangements of the parts under consideration. Not all vertebrates, not even a majority of them, possess a cochlea, consequently we should have to provide another name for the same nerve in lower forms or else have the anomaly of an animal without a cochlea provided with a "cochlear nerve."

[1] A contribution to the Morphology of the Vertebrate Ear, etc. Journ. Morph., VI., 1892.

In every aspect of the matter the sense-organ must be present before its nerve can have a separate existence. The terms "utricularis" and "saccularis" are in all respects suitable and descriptive of the things to be named. Both of the nerves to which they are applied supply parts of the same organ complex which forms a well differentiated structure, and since both parts must have very similar functions it is certainly unadvisable to leave out of the designation all reference to the accepted idea as to the function which they subserve. Consequently, I hold that the names which I used in my memoir on the ear are the most suitable and the best grounded terms yet proposed for a revised nomenclature. The names may be used in full as Nervus acusticus utricularis and Nervus acusticus saccularis, or abbreviated to N. ac. utric. and N. ac. sac., or, since they are not liable to become confused with other nerve names, we may write simply N. utric. and N. sac. For the branches of each of these nerves we may write respectively:—

N. utric. { ramus cristæ anterioris. " " externæ. " maculæ utriculi.

N. sac. { ramus cristæ posterioris. " " cochlearis. " maculæ sacculi.

HOWARD AYERS.

The Lake Laboratory, Milwaukee, Wis., Mar. 20, 1893.

The Neanderthal Skull.

I HAVE waited in the hope that some one more competent than myself would take up this matter, but, this failing, I am induced to send a short note on the enquiry into the reality of our venerable troglodyte.

Dr. Brinton quotes very high authority in his letter; few higher than Virchow could be found. But it appears to me that the whole story was not given. We are all concerned to know the exact truth and value of these old relics of pre-historic man. But just now the iconoclasts are abroad in the land, and they may, as they have done in days past, go too far on that side.

The Neanderthal skull has never been unequivocally accepted as a type, chiefly because it stood so long alone. But a race has been named after it by some anthropologists, provisionally at least — the Canstadt, etc.

The evidence in favor of its authenticity has been before the world for many years almost unchallenged, and, with all respect to the eminent men engaged in the controversy, I submit that it is not quite in accord with logic or with scientific method to base an objection against the positive testimony of the discoverer on the mere recollection of his surviving widow nearly forty years after the discovery was made.

Waiving all other considerations, we know how treacherous is the memory of an event in which we were not deeply interested (and which we only in part comprehended) after half a lifetime has passed since it occurred. And that Frau Fuhlrott was in this mental condition is obvious from Professor Virchow's own admission, that she made this statement to him in entire unconsciousness of the weighty results involved. This of itself is sufficient to greatly reduce its value.

But there is yet another important element in the problem to be considered. In Sir C. Lyell's "Antiquity of Man" he thus describes the place: "I visited the spot in 1860 in company with Dr. Fuhlrott (sic), who had the kindness to come from Elberfeld expressly to be my guide, and who brought with him the original fossil skull." "The spot is a deep and narrow ravine. The cave occurs on the precipitous southern or left side of the winding ravine, about sixty feet above the stream and a hundred feet below the top of the cliff." He then gives a sectional view, showing an opening to the surface, and adds, "Through this passage the loam which covered the floor and possibly the human body to which the bones belonged may have been washed into the cave below." "There was no stalagmite overlying the mud in which the human skeleton was found." "The loam, which was five feet thick, was removed and the human skull was noticed near the entrance, the other bones lying farther in on the same horizon. The skull and bones had lost so much of their animal matter as to adhere strongly to the tongue, agreeing in this respect with the ordinary condition of fossil bones of the post-pliocene period."

The loneliness of the Neanderthal skull has been much relieved by later discoveries, especially by that of Professors Lohest and Fraipont at Liège, but waiving this and keeping to the main point it is not easy to understand how testimony so direct and explicit can be at once overthrown by a recollection of an uninterested party after 35 years interval. It will be at once seen how widely Sir C. Lyell's description of the ground, written by an eye-witness, differs from that given in the first letter on the subject in *Science*. Moreover, Lyell's description shows that not the skull alone, but other bones, and probably the whole skeleton, were present. Our low-browed palæolithic (?) ancestor has still enough material left to make out a good case.

E. W. CLAYPOLE.

Akron, O., March 29.

Prehistoric Coil Pottery.

IN the dim past when primeval men occupied this continent, no one knows for how long a period, they raised mounds, dwelt in caves, or built towns that are now below the surface of the earth. In all this long era they used flint or stone implements for all edged tools, hammers, axes, spears, etc. At the same time having no

COIL POTTERY.

metal pots or kettles, a rough earthen ware was used for cooking and for all other uses for which we now use iron, tin, and wooden vessels. There is somewhat of a resemblance in many of the stone implements all over the world. It is only recently that it has been discovered that there is a similar resemblance in much of the pottery of this early age, especially in the coil pottery. This pottery was made by rolling clay into long strings like cord, and while soft beginning with one end to coil it round and round, increasing the size of the bottom till it assumed the desired dimensions, then shaping it up the sides (just as straw hats are made) till the required form and size was attained (see illustration). The most extraordinary part of the investigation is that this ware made in the same manner is found in the mounds of Florida and Ohio, in the cliff-dwellings of New Mexico and Arizona, in the buried cities of the cañons of these territories, also in the Connecticut Valley and under the ancient shell-heaps of Cape Cod, Mass. What a long period of time it must have taken to have this art disseminated over so vast a territory at this early age. According to the uses these pots were intended for, so were they made large or small, thick or thin, and of various shapes. It was a common practice to use some sharp instrument to dint or work up some fanciful designs without obliterating the lines of the coil; in some cases they are beautifully marked, looking like carved black oak, others made of light-colored clay in very fine coils prettily indented forming neat designs. Some of the best ware is handsomely smoothed and rubbed to almost a polished surface before baking. All are smoothed inside, before they were dry; probably some of those

intended to withstand heat have plumbago mixed in the inner surface of the vessels. There are many fanciful designs of this ware, some very large jars, pots of all shapes, bowls, cups, pitchers, etc. HENRY HALES.

Ridgewood, N. J.

The Sense of Boundary in Dogs.

I HAVE followed with much interest the discussion in *Science* caused by the recent communication of my friend, Dr. Hall, entitled "Is there a Sense of Direction?"

Dr. Hall's query recalls to my mind a striking example of animal intelligence which I witnessed in a dog, and of which I sent a brief notice at the time to the London *Spectator*.

Some eight years ago I was staying with friends who had a full-blooded Irish deer-hound. On the adjoining estate lived a pointer. Our dog was scarcely more than a year old, while our neighbor's dog was quite well along in life. The dogs had never been friendly; indeed, from the first, the pointer manifested a decided aversion to the young deer-hound. Whenever the old dog caught his youthful neighbor trespassing he would immediately drive him back over the boundary between the estates. Both dogs, even when going at full speed, would invariably stop the moment our dog had crossed the line. The two estates are virtually continuous, there being neither hedge nor fence separating them. The dividing line runs between two stone posts about a foot in height and some two hundred feet apart. These posts, of the existence of which I was quite unaware, until the singular behavior of the dogs called my attention to them, are in the summer time usually hidden by the grass, and in winter are often buried under the snow. I mention them, not because I think it at all probable they served as guides to the dogs in determining the boundary line, but merely because they enabled us to observe more accurately the phenomenon in question.

This exhibition of canine intelligence was first observed by my neighbors, who kindly pointed it out to me. It was repeated almost daily for several months, and was a constant source of amusement and wonder to those who witnessed it. The question arises, How did the pointer know where the line ran, and how did his canine neighbor know when he was safely across it? The only answer which occurs to the writer is, that dogs (some dogs, certainly) possess a very acute sense of boundary.

Whether this sense is shared by other animals I am unable to say, though, on this point, it is possible that some of your readers may be able to throw light. The question is certainly an interesting one from its bearing on the general question of animal intelligence. F. TUCKERMAN.

Berlin, Germany, Feb. 28.

The Results of Search for Paleolithic Implements in the Ohio Valley.

THOSE engaged in the recent discussion of Glacial Man have had little to say of the Ohio Valley. Without laying any claim whatever to geologic skill, I will submit some extracts from my private journal. These are submitted from the standpoint of a "field searcher" who knows nearly all the village sites and primitive remains of southern Ohio.

"May, 1891. Found in ash-pits near the Little Miami River, at Fort Ancient (Warren County), several objects of the character of those in the United States National Museum labelled from New Jersey and District of Columbia, commonly called paleoliths. These are in various styles — broken and whole, rude and well formed, large and small. Pottery fragments, bones, and flint chips side by side with the rough forms.

"Spent a large part of three days in inspecting the river banks, gravel strata and river bars. Pottery, several celts, arrow-heads, and paleoliths numerous. Two hearths discovered, the one six and the other nine feet below the surface. A modern brick was found lying just above one of them. Rough implements were gathered from the village sites and in the clay and sand of the river banks. No implement was seen protruding from the gravel layers.

"Rowed up the stream all day Saturday. Three experienced field-searchers were in the boat. No gravel bank was seen which contained implements. We saw no spot in clay bank, on village site or bar where only rude implements of paleolithic type (or approaching that type) were found. The rude objects, finished objects, pottery, etc., are always found together. Careful searching long continued might reveal isolated paleoliths. The river frequently washes cans, bricks, etc. out of its banks and transports them to remote parts. Just so it might carry a piece of pottery or a paleolith to a gravel bar and deposit it. A finder of an implement thus deposited would attach to it great importance, especially so were he a stranger in the valley."

This important point has been overlooked in the discussion. So far as Ohio goes, I think I am safe in saying, Dr. Metz is the only thorough archæologist who claims to have found paleoliths in the drift. All others have been found by travellers or persons not familiar with the prehistoric sites of occupation. Professor Wright does not claim to have found them himself. How is it that those of us who spend all of our time in archæologic work cannot find them? Were they so numerous in drift, surely we could see them whether we knew anything about geology or not. The type is fixed in everyone's mind, and while a searcher might not be able to name the deposit in which the implement occurred, he certainly could tell the implement when he saw it!

Dr. Cresson — strong in "paleolithic faith" — never found one specimen while he was for four months in my camp in Paint Valley, Ross County. Yet he often searched the creek banks or gravel exposures. My men, all good specimen hunters, quick to see an artificial object, could never find them in any kind of stratified gravel. I lay no claim to a knowledge of the gravels, but had implements been found in them geologists from Columbus or Cincinnati would have examined and named the deposits for me. During the coming summer I will spend as much time as possible in a further search for implements like those found by Metz and Mills. Any number can be found on the surface, but as yet I have not been able to find one in gravel layers. Probably my eyes are not sharp enough!

WARREN K. MOOREHEAD.

5,215 Washington Ave., Chicago, Ill., Mar. 24.

Probable Causes of Rainy Period in Southern Peru.

IN your issue of Oct. 21, Professor A. E. Douglass of Arequipa Observatory presents important facts evidencing a former rainy period in that region which is now nearly rainless. This change he attributes to a considerable increase in the elevation of the Andes in recent geological times. A most serious objection to this theory is, that in order to entirely cut off the precipitation from the trade-winds, an average height of broad mountain range not exceeding 6,000 to 8,000 feet would be necessary. Our experience in the Hawaiian Islands is that the trade-winds rarely surmount 5,000 feet of mountain, and, if they do this, they still more rarely carry much rain over that height, nearly all the moisture being precipitated upon the windward slope. It seems impossible to suppose that the Peruvian Andes were not more than at least one-half their present height during any recent geological period.

I would suggest that the glacial period was the cause of the former moisture of the climate of Peru. During the reign of ice in the southern hemisphere, it seems probable that the weather of the temperate zone was transferred to the tropic — was pushed towards the equator. Peru would at that time have enjoyed the westerly gales now prevalent in southern Chili and Patagonia, together with the heavy rains accompanying those winds.

In support of the very recent existence of such temperate zone climates in the tropics, I will adduce a fact stated to me by Professor A. B. Lyons of Oahu College, who recently found on the now arid slopes of Diamond Head buried land shells, *Achatinellæ*, of a species now only found upon the cold and wet summit of Kaala, 3,700 feet above the sea. This fact indicates that the present dry and warm climate of southeastern Oahu has been a change from one formerly cold and wet, such as would probably have existed during the ice age.

In this connection, it will be important to inquire whether any evidences exist of similar changes of climate in southern and Lower California?

SERENO E. BISHOP.

Honolulu, Dec. 7, 1892.

A Peculiar Eye.

RECENTLY, while dissecting the eye of a domestic animal, the crystalline lens was found to be divided into three lobes by deep clefts on the front (?) side. The lobes are equal and the clefts extend entirely through, so that the posterior surface is cut near the margin, making the lobes triangular in form with rounded outlines, and only slightly connected at the central point and for about one-half the radial distance outward. The eye had been kept several days, had been frozen, and was so opaque from drying and also from distribution of pigment through the aqueous humor that the interior was invisible before dissection, but one who saw the eye when quite fresh stated that it had an unusual appearance. The form appeared so remarkable to the writer that it is mentioned in the hope of drawing from some one better posted in the morphology of the lens some explanation of the peculiar structure.

C. D. MCLOUTH.

Muskegon, Mich.

Speech of Children.

APROPOS of Mr. A. Stevenson's interesting article on the speech of children, in *Science* for March 3, and Dr. Howard Lilienthal's communication in the succeeding number, it occurs to me, a bachelor who has never had much opportunity to become acquainted with young children, since he was a child himself, to inquire whether it would not be a rather difficult matter to teach a very young child the use of the first person, singular. Would he readily distinguish between the proper uses of the various words applied to himself: his name when he was spoken of, "you" when he was spoken to, and "I" or "me" which he should use in speaking of himself? Pronouns are, after all, only words used for convenience instead of nouns, and I cannot see why a person, young or old, cannot think of himself subjectively by his own name as well as by the use of the personal pronoun.

FRANCIS H. ALLEN.

West Roxbury, Mass., Mar. 20, 1893.

Singing of Birds.

I SHOULD be greatly obliged for any communications respecting the relation of singing in birds to the expression of the emotions. I have, of course, in mind the rival theories of Darwin (origin of song by sexual selection) and Herbert Spencer (song expressive of joyful emotion in general). Does the male sing only, or principally, during the time of courtship? Or is the presence or answering call of the female immaterial?

Good observations can be made incidentally, and with very little trouble, on the commoner species. And the only approach to a settlement of the question seems through statistics. I hope that the readers of *Science* will assist me in investigating the matter on this basis.

E. B. TITCHENER.

Psychological Laboratory, Ithica, N. Y.

BOOK-REVIEWS.

Third Annual Report of the Geological Survey of Texas, 1891. E. T. Dumble, State Geologist. Austin, 1892. 461 p. Pl. 16.

THIS volume is quite a bulky one and contains information on a variety of subjects. The State geologist in his annual statement mentions the work that has been carried on during the year covered by the report and gives abstracts of the work of the various assistants. The papers accompanying the report are: Houston County, by W. Kennedy. In this county none of the formations are older than the Eocene. Various sections are given and a considerable portion of the report is devoted to economic geology. Mr. Kennedy also contributes a description of a section from Terrell, Kaufman County, to Sabine Pass, on the Gulf of Mexico. Many details of sections are given, which are of interest mainly to those familiar with the region. Mr. W. T. Cummins has a report upon the geography, topography, and geology of the Llano Estacado, with notes on the country to the westward. This is of considerable interest, as it touches upon a region of which comparatively little is known. The region is likely to be of considerable importance, however, in the development of the State, as recent discoveries have shown the possibility of securing water in sufficient quantity to permit of cultivation over the larger portion of its area. Mr. Cummins, in a foot-note, refers to the various theories advanced to account for the name, discarding them all and retaining at the last the name itself. We prefer to adopt the idea of Professor Hill that the name *Llano estacado* refers to the palisade character of the escarpment which nearly surrounds the area and makes it one of the most characteristic *mesas* of the country. The conclusions of Mr. Cummins in regard to the geological structure are that the Quaternary is represented in places on top of the Llano; the Tertiary is exposed at various places in cañons penetrating the edges of the Llano; that the Cretaceous underlies the southern part, forms part of the escarpment on the eastern and southwestern sides, and for a short distance along the northern side in the vicinity of Mt. Tucumcari, New Mexico; and, finally, that the Triassic forms the basal member of the escarpment on all sides. Water can readily be procured in almost all parts of the Llano, although not flowing artesian wells. A good idea may be had of the extent of the area when we observe that no less than 29 counties are included in it. The paper is followed by a discussion of the geology of Tucumcari, New Mexico, in which the author contends from the Cretaceous age of strata previously regarded by Marcou and Hill as Jurassic. It is rather singular that Mr. Cummins concludes that a single specimen of a fossil plant occurring in the beds "is sufficient to establish the fact that the strata are no older than the Cretaceous." This specimen is imperfect, the nervation is "indistinct," but it is concluded to be a dicotyledon, and upon this ground to be of Cretaceous age. The leaf is called *Sterculia drakei*, a new species, and seemingly a new genus.

Mr. N. F. Drake follows with a paper on the Triassic of Northwestern Texas, and Professor E. D. Cope and Dr. R. W. Shufeldt describe some vertebrates in another paper. Dr. V. Sterki gives a list of shells collected in a dry salt lake near Eddy, New Mexico, and J. A. Taff discusses the Cretaceous area north of the Colorado River. The last paper in the report is on "Trans-Pecos Texas," by von Streeruwitz.

It is unfortunate that the "Library Catalogue Slips" should not have been made with more regard to accuracy. In the three slips there are no less than thirteen errors.

J. F. J.

The Journal of Geology. Vol. I, No. 1. January–February, 1893. Chicago, The University of Chicago. 112 p.

THE first number of a new publication dealing with scientific matters is always eagerly scanned. It was announced some time ago that the Chicago University expected to issue a magazine from its geological department, and the initial number of *The Journal of Geology* has now come from the press. Its editors are: T. C. Chamberlin, R. D. Salisbury, J. P. Iddings, R. A. F. Penrose, Jr., C. R. Van Hise, C. D. Walcott, and W. H. Holmes. There is besides a corps of associate editors: Sir Archibald Geikie (Great Britain), H. Rosenbusch (Germany), Charles Barrois (France), Albrecht Penck (Austria), Hans Reusch (Norway), Gerard de Geer (Sweden), J. Le Conte (California), G. K. Gilbert (Washington, D.C.), H. S. Williams (Yale University), J. C. Branner (Leland Stanford, Jr., University), G. H. Williams (Johns Hopkins), I. C. Russell (University of Michigan), and Geo. M. Dawson (Canada). These names ought to be a guarantee of an excellent journal. There are, to be sure, several journals already in the field, such as the *American Journal of Science*, the *American Geologist*, and the *American Naturalist*. The first two of these occupy the geological field to a large extent, and the third to a more limited degree. These are more or less dependent upon private enterprise, whereas the new *Journal of Geology* has the advantage, as an editorial states, "of being published under

the auspices and guarantee of the University of Chicago, and will be free from the usual embarrassments attending the publication of a scientific magazine." In other words, it will not be dependent upon a large list of subscribers for support. It is significant that the list of editors is largely made up of former members of the U. S. Geological Survey, but it is to be sincerely hoped that this will not prevent a free discussion in its pages of subjects upon which those outside of the Geological Survey happen to hold opinions opposed to those of the editorial staff. The editor-in-chief says: "It is our desire to open the pages of the *Journal* as broadly as a due regard for merit will permit, and to free it as much as possible from local and institutional aspects." He likewise states what may be assumed to be the field aspired to be occupied by the new *Journal*, when he says that "there seems to be an open field for a periodical which specially invites the discussion of systematic and fundamental themes, and of international and intercontinental relations, and which in particular seeks to promote the study of geographic and continental evolution, orographic movements, volcanic co ordinations, and consanguinities, biological developments and migrations, climatic changes, and similar questions of wide and fundamental interest." This is assuredly a high and broad field, and to successfully cultivate it will require an equally broad and cosmopolitan management.

All the leading articles in the present number are by members of the editorial staff. The table of contents includes the following papers: "On the Pre-Cambrian Rocks of the British Isles," by Sir Archibald Geikie; "Are There Traces of Glacial Man in the Trenton Gravels?" by W. H. Holmes; "Geology as a Part of a College Curriculum," by H. S. Williams; "The Nature of the Englacial Drift of the Mississippi Basin," by T. C. Chamberlin; "Distinct Glacial Epochs and the Criteria for their Recognition," by R. D Salisbury. There are also editorials, a review of a paper by James Geikie, analytical abstracts of current literature, and acknowledgments of articles donated to the Geological Departments of the University. The *Journal* will be issued semi-quarterly at the price of $3 per annum.

Proceedings of the Ninth Annual Convention of the Association of Official Agricultural Chemists. Bulletin No. 35, U. S. Department of Agriculture, Division of Chemistry. 243 p. 8°.

The report of the Proceedings of the Association of Official Agricultural Chemists is looked forward to with expectation by every analyst. The carefully recorded laboratory experience with the "old" methods and the suggestion and regulation of the new, form together a valuable annual hardly to be dispensed with by any engaged in practical analytical work. The report of the meeting held in Washington Aug. 25, 26, and 27, 1892, being the ninth of the series, is fully as interesting as those of previous years, and, moreover, there is a very apparent improvement in the nature and method of discussion. The contents are familiar to all, being in brief as follows: Address of the President, Mr. N. T. Lupton, report on dairy products, on phosphoric acid, potash, nitrogen, soils, ash, cattle foods, sugar, fermented liquors, etc., with papers on the particular determinations, and, in conclusion, the official methods adopted in each case for the coming year.

C. P.

Matter, Ether, and Motion. By A. E. Dolbear, Ph.D., Professor of Physics, Tuft's College. Boston, Lee & Shepard.

This book is written apparently for those who, having never made such a study of scientific work as would enable them to read scientific treatises, are disirous of getting a clear idea of the chief results of scientific investigation. For such this book will have a considerable value; which, however, would have been greater if the author had refrained from including a good many of his own theories. For instance, it is not good that the reader should be told, cocksuredly and in italics (pages 235–7), that "electricity is a phenomenon of rotating molecules." If the author had merely stated it as his own theory, the reader

would not be so apt to fall into error as when (as in the case considered) an entirely incorrect theory is embedded, labelless, in a mass of facts.

The book is very clearly written and the style is good. The only misprints in the book appear to be those on pages 80 and 81, where the velocity of light is twice given as 185 miles per second.

Magnetism and Electricity. By ARTHUR WILLIAM POYSER, M A., Headmaster of Wisbech Grammar School. London and New York, Longmans, Green & Co.

THIS book is arranged in the same way as Silvanus P. Thompson's text-book, and is intended for the same purpose. In some ways it is more complete than the latter, and the type is larger and clearer. The illustrations, especially, are well drawn, and it is with delight that one realizes the absence of most of the old stereotypes which have done duty in so many scores of text-books. This is explained in the preface, where we learn that out of the 317 engravings in the book, more than 200 are from original drawings. At intervals throughout the book are given the directions for some 200 experiments, evidently carefully selected, and there are also twenty four sets of exercises given, with the answers to the more difficult examples in them. The book seems one of the best suited for teaching purposes that has appeared and is brought quite up to date. It needs amplifying, however, in those parts which relate to magnetic circuits and permeability.

R A. F.

Catalogue of American Localities of Minerals. By EDWARD S. DANA. From the 6th Edition of Dana's Mineralogy. New York, J. Wiley & Sons, 1893. 51 p. 8°.

THIS catalogue will serve a useful purpose in enabling students of mineralogy to readily ascertain just where in any State or Territory the best localities for minerals are. The information is classified under States, beginning with Maine and ending with Alaska, and followed by the Canadian provinces. A few general remarks are made under each State, Territory or Province, and then follow the counties and the towns where the mineral localities are. It would have been made more valuable by the addition of an index to the minerals mentioned, since then it would have been possible to ascertain in a few moments where any particular species occurs.

AMONG THE PUBLISHERS.

S. C. GRIGGS & Co., Chicago, announce for early publication a work by Elizabeth A. Reed, author of "Hindu Literature," etc., entitled "Persian Literature, Ancient and Modern."

— Mr. William Salter, the author of "Ethical Religion," has issued, through Charles H. Kerr & Co. of Chicago, a small book, entitled "First Steps in Philosophy." It is very plain and simple in style and as free as possible of technical terms; and in these respects is well adapted to its purpose. It omits so much, however, that it can hardly be deemed a sufficient introduction to philosophical study. It gives no general view of the problems of philosophy nor of the methods of studying it. The general theory of knowledge is not touched upon; and the question of theism is not raised, the first part of the book being wholly devoted to the doctrine of perception and the nature of matter. The author's views on these points are substantially those of the idealists; though he shows a certain leaning towards realism, and evidently is not quite satisfied with the idealistic theory. The second part of the book, which treats of ethics, is much more satisfactory, and will be read with interest even by those who do not accept the author's views. He discusses the nature and foundation of duty, criticises the doctrines of intuitionalists and utilitarians, and gives as his own theory one substantially like that of Hegel, which regards the complete realization of everyone's nature as the supreme end of action. Though not wholly satisfactory, this little book may serve to awaken the philosophic impulse in minds naturally susceptible of it, and be the propedeutic to more elaborate studies.

Exchanges.

[Free of charge to all, if of satisfactory character. Address N. D. C. Hodges, 874 Broadway, New York.]

Fine collection of microscopic slides for sale, or would exchange for first-class pneumatic bicycle. J. E. Whitney, Box 549, Rochester, N. Y.

For sale—A Zentmayer new model U. S. Army Hospital monocular stand. Price $110, will sell for $75. Address H. C. Wells, No. 151 Broadway, New York.

For sale—A complete set of the third series of the American Journal of Science (1870–1893) handsomely bound in single volumes in dark brown half morocco. Address G. H. Williams, 808 Cathedral Street, Baltimore, Md.

For sale, or for exchange for books on medicine or surgery, new editions only, a large geological library, containing nearly all the State and Government Reports since 1850. Will be pleased to answer letters of inquiry and give information. Address R. ELLSWORTH CALL, Louisville, Ky.

For exchange.—Slides of Indian Territory Loup Fork Tertiary Diatoms for other microscopic fossils. Address S. W. WILLISTON, Univ. of Kansas, Lawrence, Kans.

For exchange.—Will exchange an "Ideal" Microscope of R and J. Beck, London, 2 eye pieces 3 objectives, 3 inch, 1 inch, 1-6 inch; bull's eye condenser on stand, substage condenser, mechanica stage, etc., for any of the leading makes of type writers. Particulars by mail. DELOS FALL, Albion College, Albion, Mich.

For sale or exchange.—I have a few copies of my translation of "Strasburger's Manual of Vegetable Histology, 1887," now out of print, which I will send post-paid for $3 or for one dozen good slides illustrating plant or animal structure. Address A. B. Hervey, St. Lawrence University, Canton, N. Y.

The undersigned has the following specimens to exchange for crystals of any eastern or foreign localities or Indian relics: tin ore, metacinnabarite, stibnite, garnierite, calenanite, hanksite, ulexite, rubellite, lepidolite, blue and green onyx, Cal. pinelite, aragonite on chalcedony, cinnabar, double refracting spar, clear and clouded, and others. J. R. Bush, care of General Delivery, Los Angeles, Cal.

For sale or exchange.—A private cabinet of about 200 species of fossils, well distributed geologically and geographically. Silurian, about 40; Devonian, about 50; Carboniferous, about 60; others, about 50. Frank S. Aby, State University, Iowa City, Ia.

Wants.

THE undersigned desires specimens of North American Gallinae in the flesh for the study of their pterylosis. These species are especially desired: *Colinus ridgwayi, cyrtonyx montezumae, dendragapus franklini, lagopus welchi, tympanuchus cupido* and *pediocetes phasianellus*. Any persons having alcoholic specimens which they are willing to loan or who can obtain specimens of any of the above are requested to communicate with Hubert Lyman Clark, 3962 Fifth Avenue, Pittsburgh, Pa.

WANTED—Second-hand copy Tryon's Systematic Conchology. Please quote condition, date, price. H. L. Osborn, Hamline University, St. Paul, Minn.

A COMPETENT TEACHER of botany in college or university is open to engagement. Address L., Box 86, Rochester, Mich.

CAN any one inform me as to the age to which cats have lived? I have one twenty years old. Edward D. Webb, 122 W. Eighty-first St., New York.

WANTED — Second-hand. Foster's Physiology, Balfour's Comparative Embryology, Claus & Sedgwick's Zoology, Flower's Osteology of Mammalia, Vine's Physiology of Plants. Please state editions and prices asked and address Richard Lees Brampton, Ontario, Canada.

WANTED.—American Journal of Conchology, seven volumes. Parties having these for sale will please address the undersigned, stating condition and price. R. Ellsworth Call, Louisville, Ky.

A GRADUATE ENGINEER will give instruction evenings in geometry, trigonometry and surveying, mechanics, physics, mechanical drawing and general engineering construction. Five years' experience in field and editorial work on engineering journal. References furnished. C. S. H., 102 Tribune Building, New York.

WANTED.—By well-qualified and experienced science master and associate of the Royal School of Mines, London, aged 26 (at present in England), a mastership in technical college or university for any of the following subjects: Engineering sciences, geology and mineralogy, physics, chemistry and metallurgy, etc., etc. Can provide excellent references and credentials. Apply, J. G., 17 Sussex St., Rochdale, England.

TO THOSE INTERESTED IN SCIENCE.

[Science (weekly) established in 1883, N. D. C. HODGES, 874 Broadway, New York City.]

Titles of Some Articles Published in *Science* since Jan. 1, 1892.

Aboriginal North American Tea.
Actinism.
Agriculture, Experimental, Status of.
Amenhotep, King, the tomb of.
Anatomy, The Teaching of, to Advanced Medical Students.
Anthropology, Current Notes on.
Architectural Exhibition in Brooklyn.
Arsenical Poisoning from Domestic Fabrics.
Artesian Wells in Iowa.
Astronomical Notes.
Bacteria, Some Uses of.
Bird on its Nest, The.
Birds Breeding at Hanover, N. H.
Botanical Laboratory, A.
Botanists, American and Nomenclature.
Brain, A Few Characteristics of the Avian.
Bythoscopidæ and Cercopidæ.
Canada, Royal Society of.
Celts, The Question of the.
Chalicotherium, The Ancestry of.
Chemical Laboratory of the Case School.
Children, Growth of.
Collection of Objects Used in Worship.
Cornell, The Change at.
Deaf, Higher Education of the.
Diamonds in Meteorites.
Diphtheria, Tox-Albumin.
Dynamics, Fundamental Hypotheses of.
Electrical Engineer, The Technical Education of.
Eskimo Throwing Sticks.
Etymology of two Iroquoian Compound Stems.
Eye-Habits.
Eyes, Relations of the Motor Muscles of, to Certain Facial Expressions.
Family Traits, Persistency of.
Fishes, The Distribution of.
Fossils, Notice of New Gigantic.
Four-fold Space, Possibility of a Realization of.
Gems, Artificial, Detection of.
Glacial Phenomena in Northeastern New York.
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Some of the Contributors to *Science* Since Jan. 1, 1892.

Aaron, Eugene M., Philadelphia, Pa.
Allen, Harrison, Philadelphia, Pa.
Ashmead, Albert S., New York City.
Bailey, L. H., Cornell University, Ithaca, N. Y.
Baldwin, J. Mark, University of Toronto, Canada.
Ball, V., C. B., LL.D., F.R.S., Dublin, Ireland.
Barnes, Charles Reid, Madison, Wis.
Baur, G., Clark University, Worcester, Mass.
Beal, W. J., Agricultural College, Mich.
Beals, A. H., Milledgeville, Ga.
Beauchamp, W. M., Baldwinsville, N.Y.
Bell, Alexander Graham, Washington, D. C.
Boas, Franz, Clark University, Worcester, Mass.
Bolley, H. L., Fargo, No. Dak.
Bolles, Frank, Cambridge, Mass.
Bostwich, Arthur E., Montclair, N J.
Bradley, Milton, Springfield, Mass.
Brinton, D. G., Philadelphia, Pa.
Call, E. Ellsworth, Des Moines, Ia.
Chandler, H., Buffalo, N.Y.
Comstock, Theo. B., Tucson, Arizona.
Conn, H. W., Middletown, Conn.
Coulter, John M., Indiana University.
Cragin, F. W., Colorado Springs, Col.
Creeson, Hilborne T., Philadelphia, Pa.
Davis, W. M., Harvard College, Cambridge, Mass.
Dimmock, George, Canobie Lake, N.H.
Dixon, Edward T., Cambridge, England.
Farrington, E. H., Agric. Station, Champaign, Ill.
Ferree, Barr, New York City.
Fessenden, Reginald A., Lafayette, Ind.
Flexner, Simon, Johns Hopkins, Baltimore, Md.
Foshay, P. Max, Rochester, N.Y.
Gallaudet, E. M., Kendall Green, Washington, D.C.
Garman, S., Mus. Comp. Zool., Cambridge, Mass.
Gibbs, Morris, Kalamazoo, Mich.
Golden, Katherine E., Agric. College, Lafayette, Ind.
Grinnell, George B., New York City.
Hale, Edwin M., Chicago, Ill.
Hale, George S., Boston, Mass.
Hale, Horatio, Clinton, Ontario, Canada.
Hall, T. Proctor, Clark University, Worcester, Mass.
Halsted, Byron D., Rutg. Coll., New Brunswick, N.J.
Haworth, Erasmus, Oskaloosa, Iowa.
Hay, O. P., Irvington, Ind.
Haynes, Henry W., Boston Mass.
Hazen, H. A., Weather Bureau, Washington, D.C.
Hewitt, J. N. B., Bureau of Ethnol., Washington, D. C.
Hicks, L. E., Lincoln, Neb.
Hill, R. J., Chicago, Ill.
Hill, Geo. A., Naval Observatory, Washington, D.C.
Hitchcock, Romyn, Washington, D.C.
Holmes, E. L. Chicago, Ill.
Hoskins, L. M., Madison, Wis.
Hotchkiss, Jed., Staunton, Va.
Houston, Edwin J., Philadelphia, Pa.
Howe, Jas. Lewis, Louisville, Ky.
Hubbard, Gardiner G., Washington, D.C.
Jackson, Dugald C., Madison, Wisconsin
James, Joseph F., Agric. Dept., Washington, D.C.
Johnson, Roger B., Miami University, Oxford, O.
Keane, A. H., London, England.
Kellerman, Mrs. W. A., Columbus, O.
Kellicott, D. S., State University, Columbus, O.
Kellogg, D. S., Plattsburgh, N. Y.
Lintner, J. A., Albany, N. Y.
Loeb, Morris, New York City.
Mabery, Charles F., Cleveland, Ohio.
Mackenzie, G., Princeton, N.J.
McCarthy, Gerald, Agric. Station, Raleigh, N. C.
MacDonald, Arthur, Washington, D.C.
MacGregor, J. C., Halifax, Nova Scotia.
MacRitchie, David, Easter Logie, Perthshire, Scotland.
Marshall, D. T., Metuchen, N.J.
Mason, O. T., Smithsonian Inst., Washington, D. C.
Mill-paugh, Charles F., Morgantown, W. Va.
Morse, Edward S., Salem, Mass.
Nichols, C. F., Boston, Mass.
Nuttall, George H. F., Johns Hopkins, Baltimore Md.
Oliver, J. E., Cornell University, Ithaca, N.Y.
Osborn, Henry F., Columbia College, New York City.
Osborn, Herbert, Agricultural College, Ames, Iowa.
Pammel, L. H., Agricultural Station, Ames, Iowa.
Pillsbury, J. H., Smith College, Northampton, Mass.
Poteat, W. L., Wake Forest, N. C.
Preble, Jr., W. P., New York City.
Prescott, Albert B., Ann Arbor, Mich.
Riley, C. V., Washington, D. C.
Ruffner, W. H., Lexington, Va.
Sanford, Edmund C., Clark Univ., Worcester, Mass.
Scripture, E. W., Clark University, Worcester, Mass.
Seeler, Dr. Ed., Berlin, Germany.
Shufeldt, R. W., Washington, D.C.
Slade, D. D., Museum Comp. Zool., Cambridge, Mass.
Smith, John B., Rutgers Coll., New Brunswick, N. J.
Southwick, Edmund B., New York City.
Stevens, George T., New York City.
Stevenson, S. Y., Philadelphia, Pa.
Stone, G. H., Colorado Springs, Col.
Taylor, Isaac, Settrington, England.
Thomas, Cyrus, Washington, D. C.
Thurston, R. H., Cornell University, Ithaca, N.Y.
Todd, J. E., Tabor, Iowa.
True, Frederick W., Nat. Mus., Washington, D.C.
Turner, C. H., Univ. of Cincinnati, Cincinnati, O.
Wake, C., Staniland, Chicago, Ill.
Ward, R. DeC., Harvard Univ., Cambridge, Mass.
Ward, Stanley M., Scranton, Pa.
Warder, Robert B., Howard Univ., Washington, D.C.
Welch, Wm. H., Johns Hopkins, Baltimore, Md.
West, Gerald M., Clark University, Worcester, Mass.
Whitman, C. O., Clark University, Worcester, Mass.
Williams, Edward H., Lehigh Univ., Bethlehem, Pa.